Coupled Environmental Model Prediction (CEMP)

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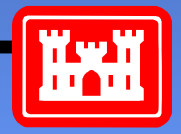

FY 2002 DoD Challenge Project

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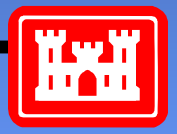
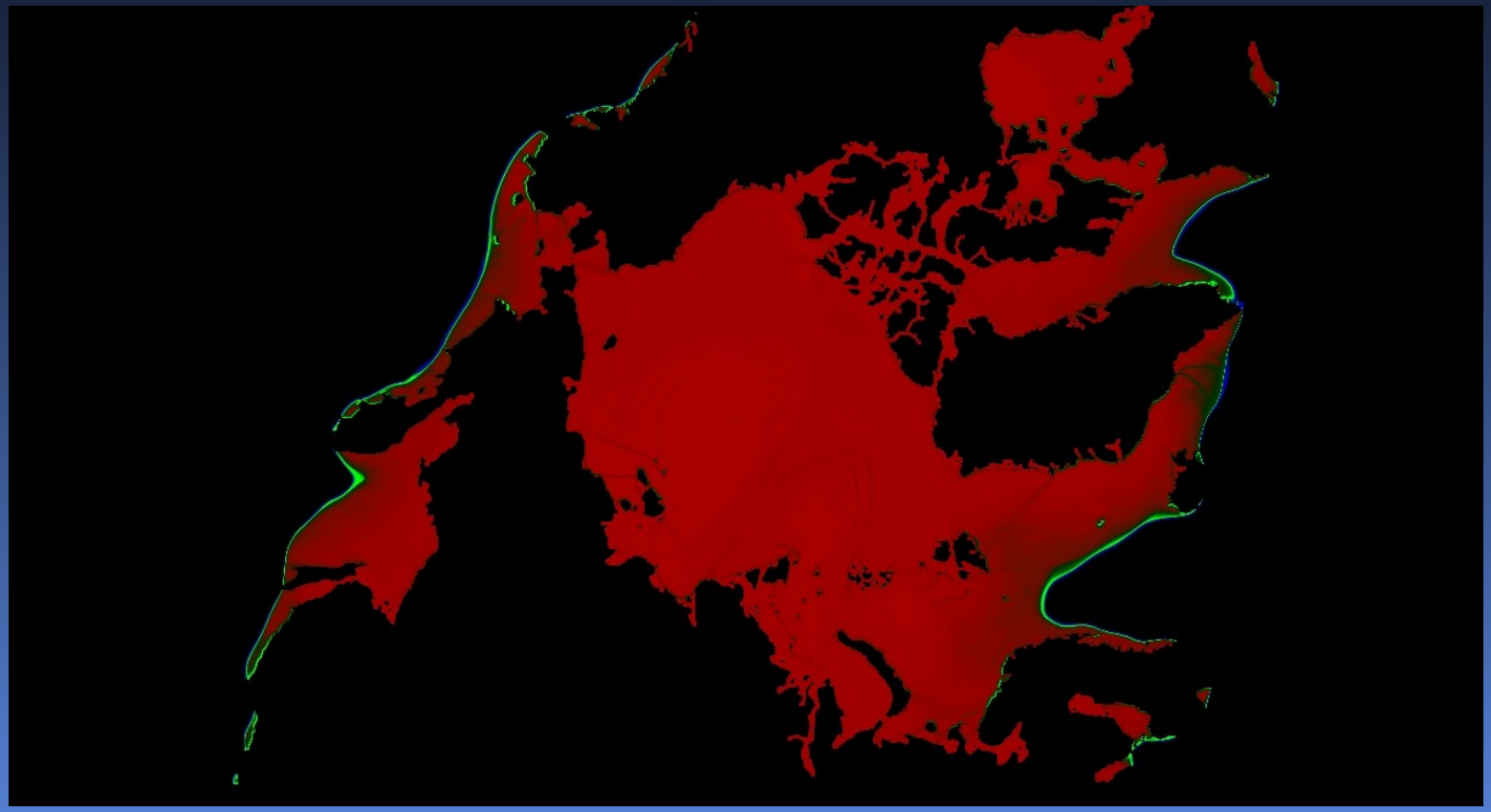
Sponsor : U.S. Navy



Where Is This?



Now, Where Is This?

Now, Where Is This?

Coupled Environmental Model Prediction (CEMP)

Goal: Develop coupled ocean/ice/air prediction models to provide short to long-term forecasts in the battle space.

A state of the art coupled pan-Arctic ice-ocean model to improve the Navy's Operational forecast of sea ice and ocean conditions.

Arctic Sea Ice

Ice draft in the 1990s was more than a meter thin
than 2 to 4 decades earlier.

Mean draft has decreased from more than 3m to u

Volume is down ~ 40 percent

Goal

The U.S. Navy will be able to produce unique, high resolution operational analysis and forecasts of the atmosphere and ocean.

Simulation Goal

Realistic simulation of the present-day sea ice thickness distribution

Crucial to predicting a possibility of partial/seasonal full removal of permanent sea ice cover in the Arctic Ocean during the next century

Conceptual Model

- Seawolf class submarine
- Modeled in Maya
- Shows ice breaking

Data Set Size

- 45 variables
- 170 megabytes simulated data / day
- 60 gigabytes data (year)
- 1.2 terabytes (20 years)

Challenges

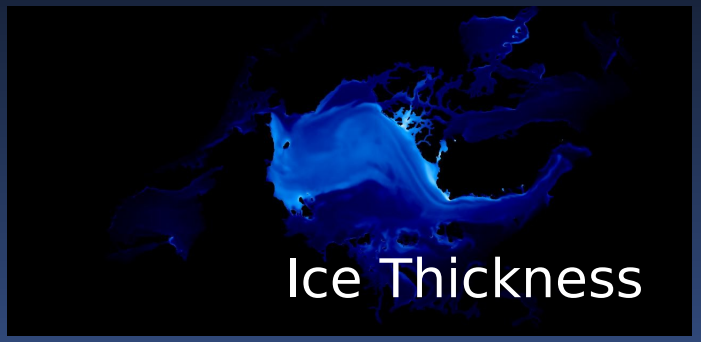
Forty-five variables

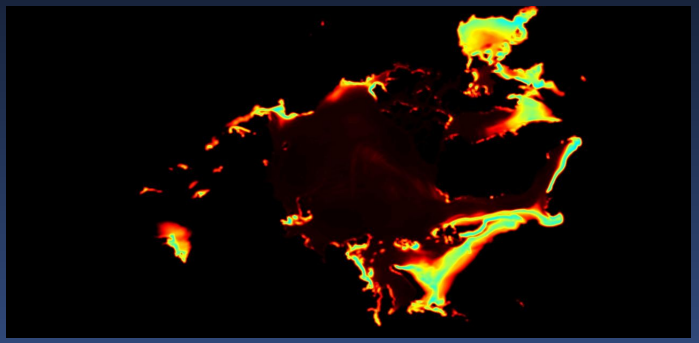
Requires visualization of coupled variables
(i.e. ice concentrations/ice thickness)

Extensive computational and mass storage capabilities are necessary.

LOD

Arctic Ice





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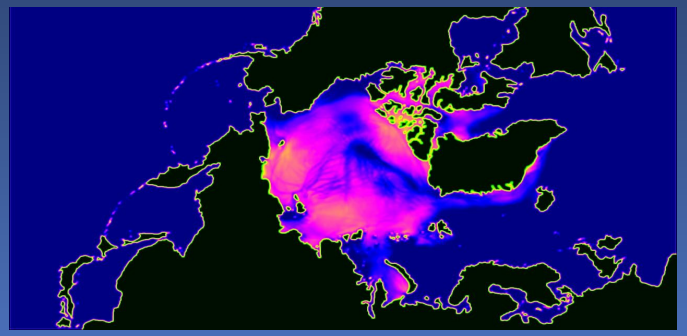

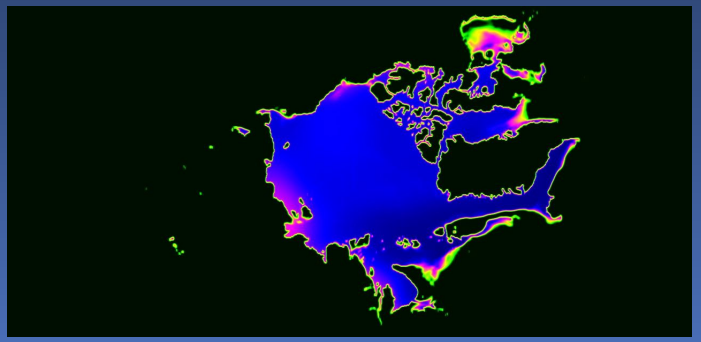

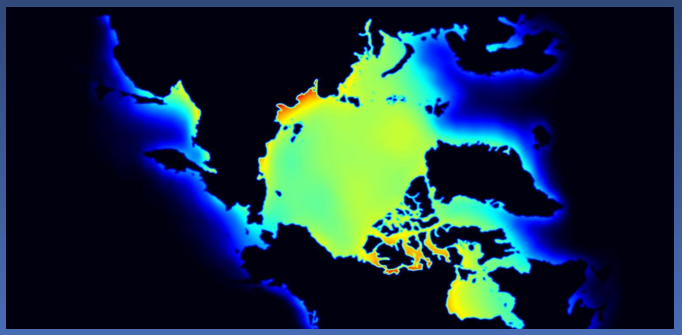

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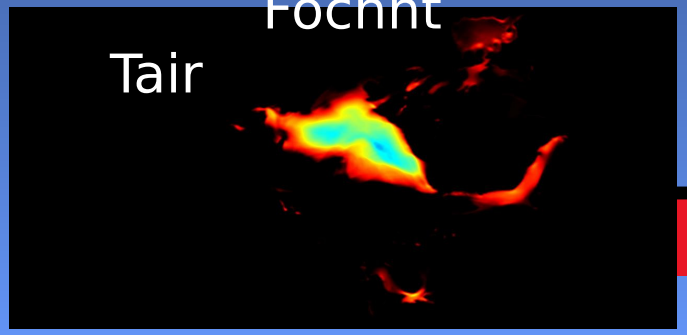
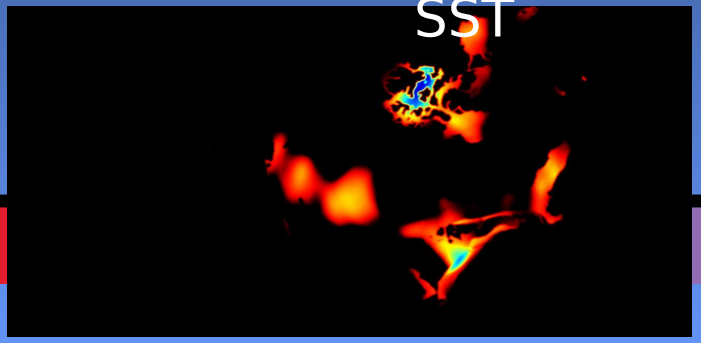
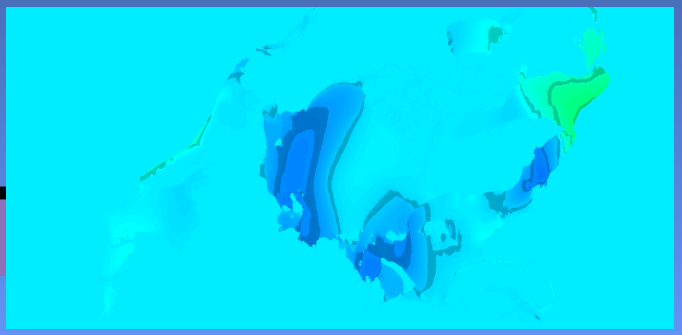




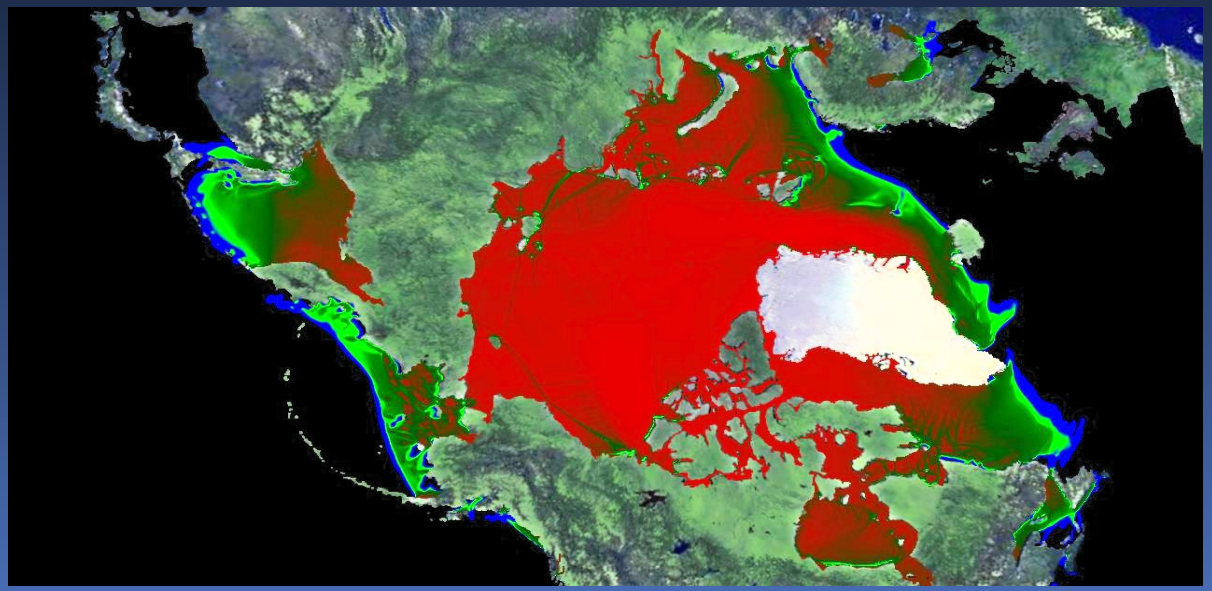


Arctic Sea Ice

IDL for handling the incoming NetCDF datasets, data processi

Code written in C++

Rendered in Maya and Lightwave



Arctic Sea Ice

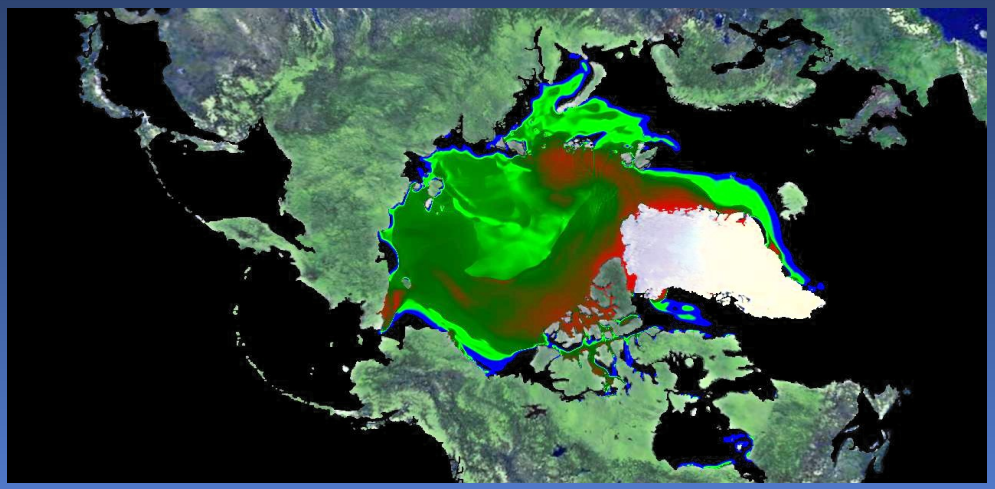
Animations 1 year duration of daily sea ice

Ice thickness / Ice concentrations
Ice thickness / u,v directional velocities
Ice thickness / Air surface temperature

Arctic Sea Ice

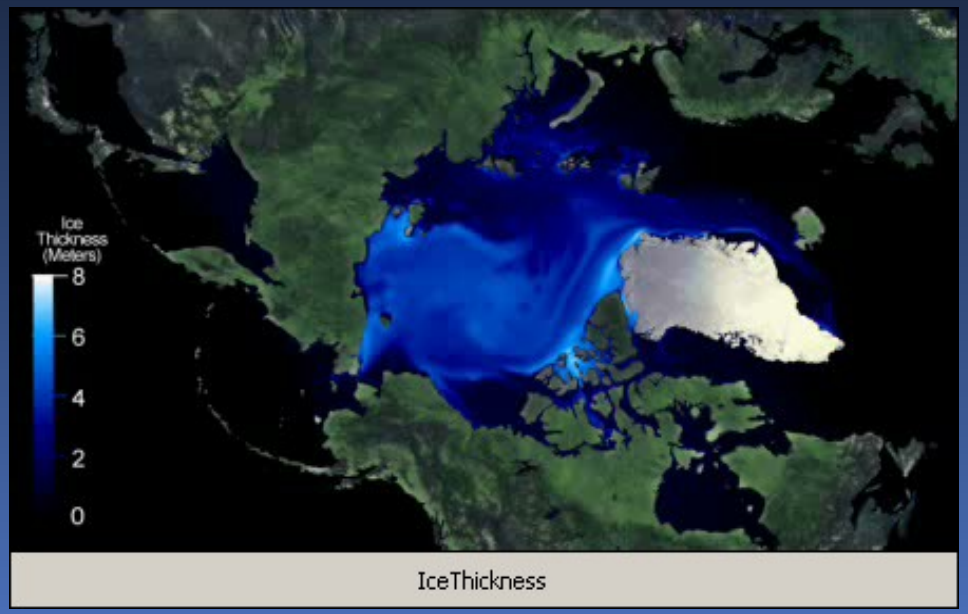
Seasonal differences
Ice concentrations in percentages

March

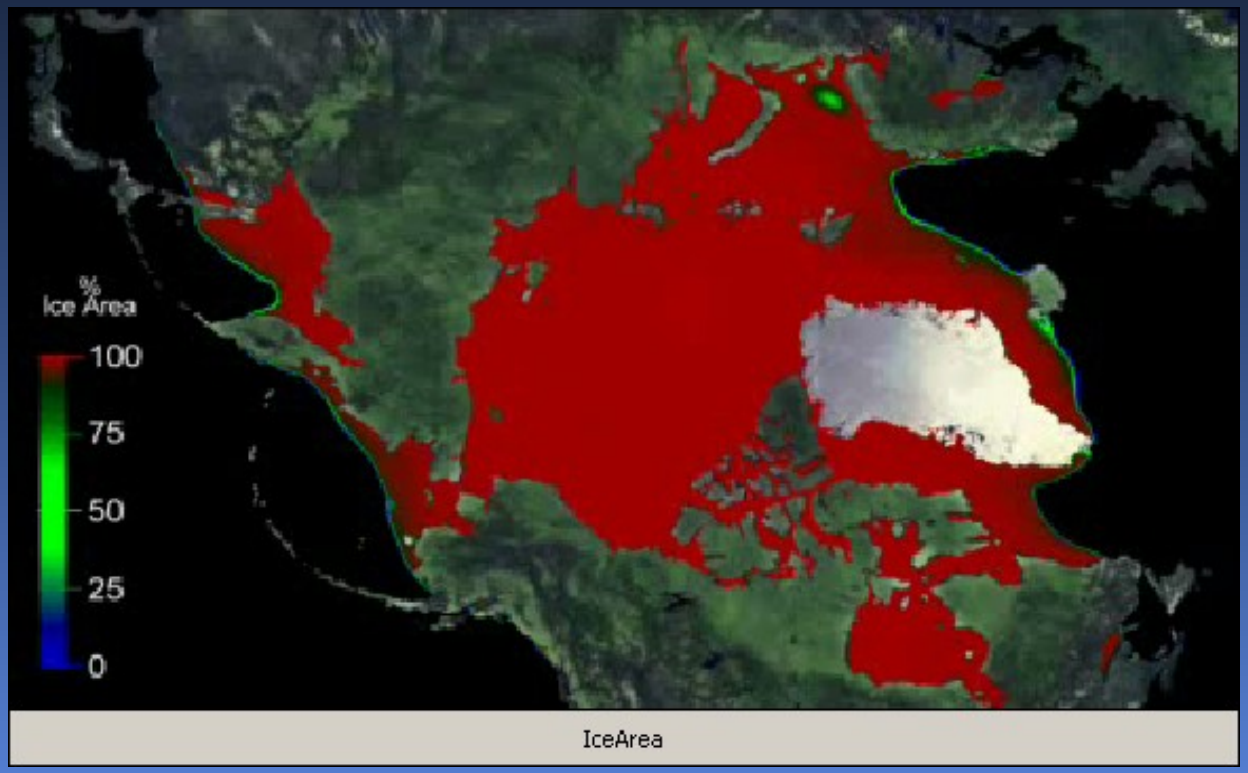


August

Arctic Sea Ice Thickness



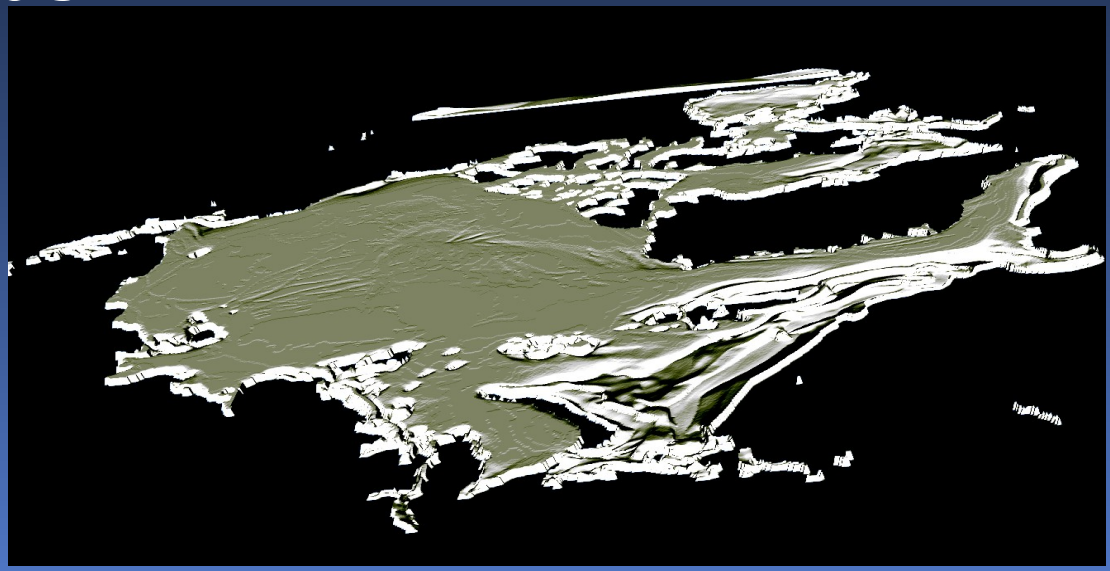
Arctic Sea Ice Concentration



Generation of Isosurfaces

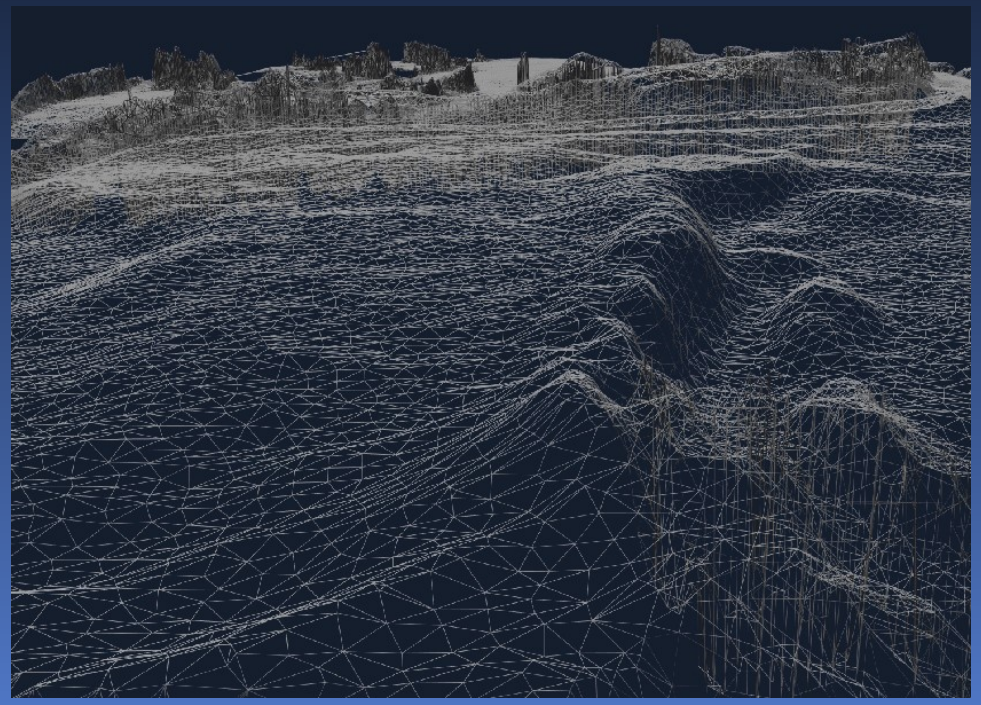
Custom “C” code reads in image file created from NetCDF file processed using IDL

Code output .OBJ file

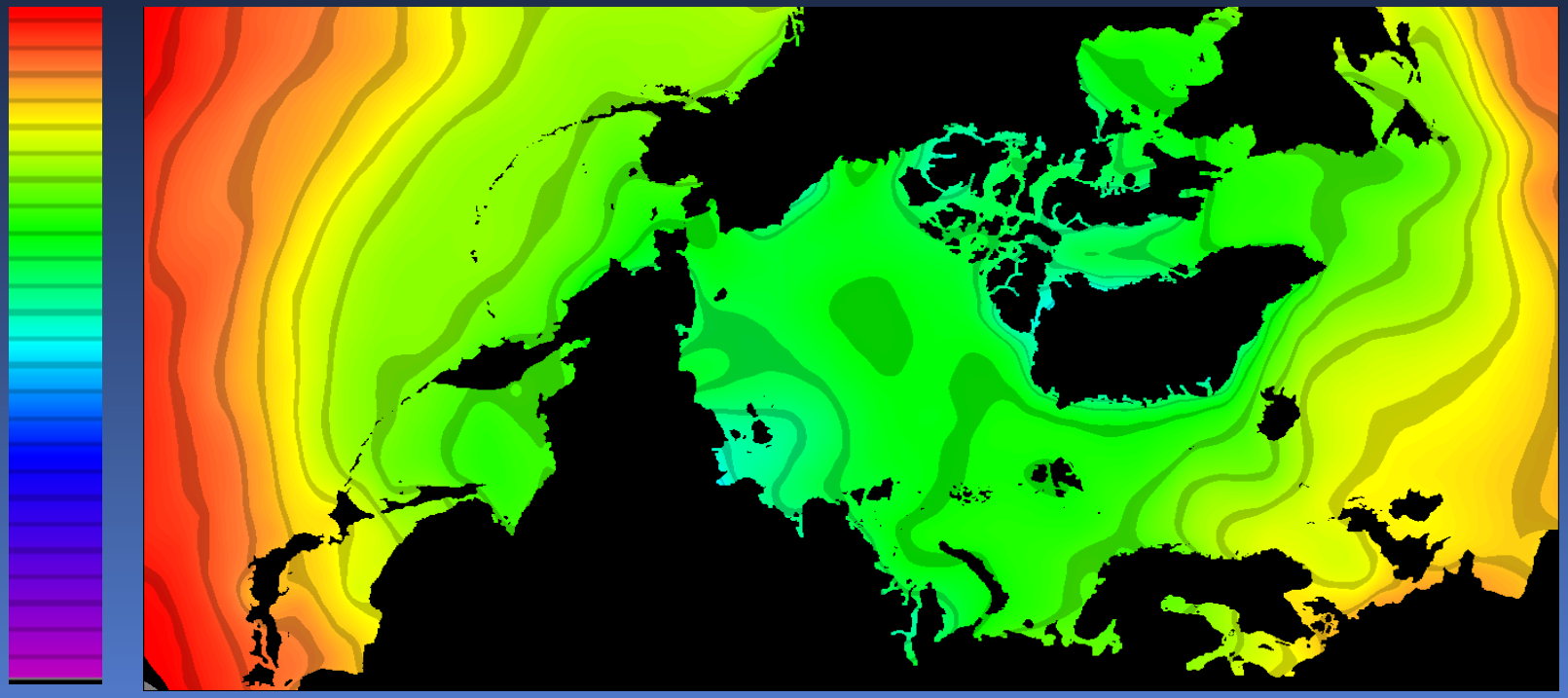


Grid Generation

- 1.5 million polygons per time step

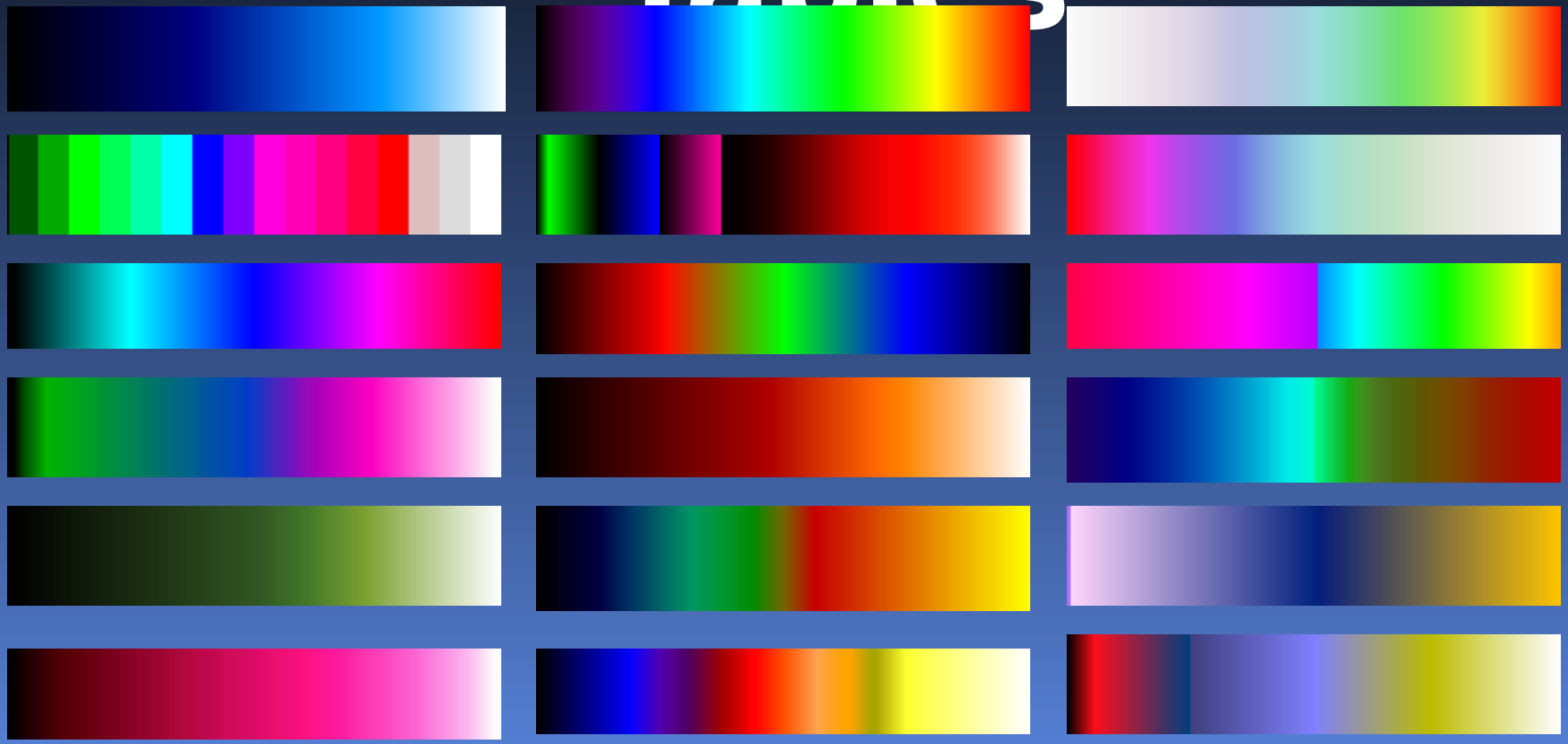


Contours

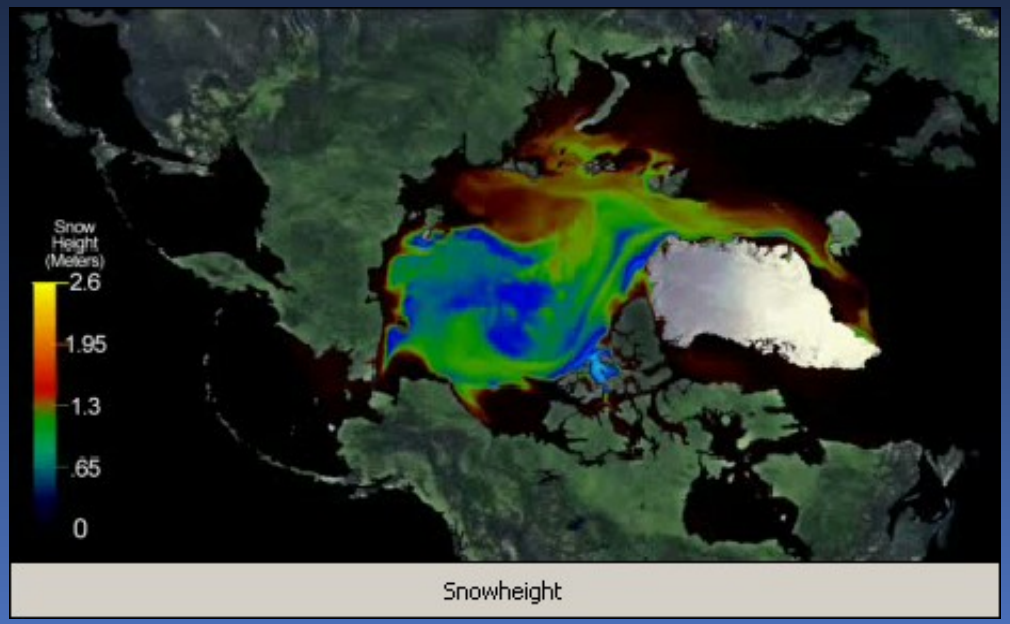


Surface Air Temperature

Selecting the Color Tables



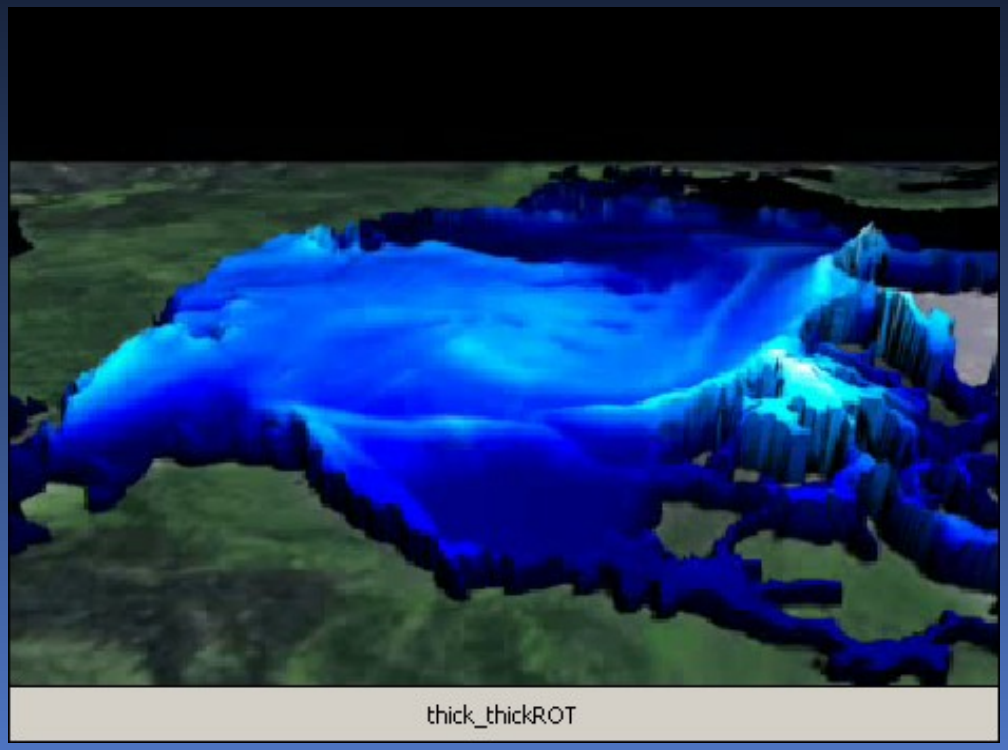
Arctic Sea Ice Snow Height



Arctic Sea Ice

Arctic sea ice thickness isosurface with texture

Arctic Sea Ice



Ice concentration isosurface

Additional Thanks to…

- David Longmire – Video Production
- Randy Kleinman – Senior Conceptual Animator
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